

## **REMARKS**

Applicant thanks the Examiner for the very thorough consideration given the present application.

Claims 1-5 are now present in this application. Claims 1 and 5 are independent.

Amendments have been made to the Abstract of the Disclosure and specification, and claims 1, 4 and 5 have been amended. Reconsideration of this application, as amended, is respectfully requested.

### **Priority Under 35 U.S.C. § 119**

Applicant thanks the Examiner for acknowledging Applicant's claim for foreign priority under 35 U.S.C. § 119, and receipt of the certified priority document.

### **Objection to the Drawings**

The Examiner has objected to the drawings because the feature "fourth slots" must be shown or canceled from the claims.

In order to overcome this objection, Applicant is concurrently submitting Proposed Drawing Corrections for the Examiner's approval, which address each

and would overcome this objection. Reconsideration is respectfully requested.

The Examiner has also objected to Figures 1-5, asserting that they should be designated by a legend such as --Prior Art--.

In order to address this objection, Applicant respectfully submits that the suggestion in MPEP § 608.02(g) of the use of the phrase --Prior Art-- does not exclude the use of alternate phrases, for example, "Background Art" and "Conventional Art". These alternative phrases may be found in many U.S. Patents issued today. The intent of MPEP § 608.02(g) is to distinguish Applicant's invention from that which is not Applicant's invention. If a drawing figure illustrates only material which is known to be statutory prior art to the invention, then the use of the phrase --Prior Art-- in the drawing figure would be proper. However, if it is not clear whether such material is statutory prior art, then the use of the phrase --Prior Art-- in the drawing figures would not be proper, and a label such as "Background Art" or "Conventional Art" would be more appropriate.

Applicant submits that the Drawing Correction Authorization Request submitted concurrently with this Response which includes the label "Background Art" meets the criteria of MPEP § 608.02(g) and are sufficient to distinguish Applicant's invention from that which is not Applicant's invention. Accordingly, reconsideration and withdrawal of this objection, and approval of the proposed drawing corrections submitted concurrently herewith are

Abstract of the Disclosure

Applicant has amended the Abstract of the Disclosure in order to place it in better form.

Specification Objection

The Examiner has objected to the specification because of several informalities. In order to overcome this objection, Applicant has amended the specification in order to correct the deficiencies pointed out by the Examiner. In addition, a Substitute Specification is being provided in order to place the application in better form. Also included is a marked-up copy of the original specification which shows the portions of the original specification which are being added and deleted. Applicant respectfully submits that the substitute specification includes no new matter and that the substitute specification includes the same changes as are indicated in the marked-up copy of the original specification showing additions and deletions. Reconsideration and withdrawal of this objection are respectfully requested.

Claim Amendments

Applicant has amended the claims in order to correct minor typographical errors, and to place the claims in better form. The claims have not been narrowed in scope. Instead, the claims have been amended merely to recite the subject matter therein more clearly.

Rejection Under 35 U.S.C. § 112, 2<sup>nd</sup> Paragraph

Claim 4 stands rejected under 35 U.S.C. § 112, 2<sup>nd</sup> Paragraph. This rejection is respectfully traversed.

The Examiner has set forth certain instances wherein the claim language lacks antecedent basis.

In order to overcome this rejection, Applicant has amended claim 4 to correct the deficiency specifically pointed out by the Examiner. Applicant respectfully submits that claim 4, as amended, particularly points out and distinctly claims the subject matter which Applicant regards as the invention. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

Rejection Under 35 U.S.C. § 102

Claims 1-5 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,631,440 to Robbins. This rejection is respectfully traversed.

A complete discussion of the Examiner's rejection is set forth in the Office Action, and is not being repeated here.

In the preferred embodiment of Robbins, smoother screen edges are said to be produced by slightly extending partial slots beyond the edge of the array. This embodiment is shown in FIG. 3, wherein an exaggerated computer plot of an array in which the slot length and the number of pitches is kept constant, and in which

partial slots 34 in odd numbered columns extend beyond the full length slots 33 in even numbered columns by a constant amount (see Robbins, Col.4, lines 33-38). With this arrangement, the full length first slots of Robbins can never be connected with the edge of the effective area of the shadow mask. Since the short slots 34 must extend beyond the full length slots, bridges portions (not slots) are connected to the edge of the effective area of the mask.

Therefore, Robbins fails to teach all of said first slots having an opening connected to and extending from an edge of an effective area of the shadow mask, as recited in independent claim 1 (as amended), and similarly stated in independent claim 5 (as amended).

Further, in the device of Robbins, smooth screen edges are said to be obtained when the length of the partial slots range between 50% - 80% of the lengths of full length slots (Robbins, Col.4, lines 33-38). In Applicant's claimed invention, good results, including smooth screen edges are obtained at all points in ranges between 70% and 110% of a full length slot (inclusive of the 70% and 110%). By contrast, Robbins is silent as to results obtained (smooth screen edges) for first slots having a length of (for example) 110% of a length of a full length slot. The effective range of Robbins is much narrower than the claimed range, and does not encompass all of the claimed lengths, especially first slot lengths greater than of length of 80% of a length of a full length slot. Therefore, the '102 rejection is not

limited to every possible slot length within Applicant's claimed range. Particularly, Robbins fails to teach smooth screen edges are obtained for the

effective surface of the shadow mask at every length of the first slots between and inclusive of 70%-110% of a vertical length of a fourth slot, as recited in independent claim 1, as amended.

Claims 2-4 depend, either directly or indirectly on independent claim 1, and therefore are patentable at least for the reasons stated with respect to independent claim 1. Reconsideration and withdrawal of this art grounds of rejection are respectfully requested.

### Conclusion

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone Percy L. Square, Registration No. 51,084, at (703) 205-8034, in the Washington, D.C. area.

Prompt and favorable consideration of this Amendment is respectfully

Attached hereto is a marked up version of the changes made to the application by this Amendment.



**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

*In the Abstract of the Disclosure:*

The Abstract of the Disclosure has been amended as follows:

--ABSTRACT OF THE DISCLOSURE

[Disclosed is a] A CRT (Cathode Ray Tube), in which lengths of the vertical axes (Y-axes) of outermost row slots of a long side of a shadow mask, slots adjacent to the outermost row slots in a central direction of the shadow mask and slots adjacent to the adjacent slots in a central direction of the shadow mask are maintained in the range of 70% ~ 110% of a length of a vertical axis (Y-axis) of a perfect slot., thereby providing a visually stable screen. The color CRT includes a panel having a luminescent screen on an inner surface thereof, a funnel connected to the panel, an electron gun mounted on a neck part of the funnel, the electron gun emitting electron beams toward the luminescent screen, a shadow mask disposed in a fixed interval to the luminescent screen, a shadow mask disposed in a fixed interval to the luminescent screen formed on the inner surface of the panel, the shadow mask serving to select colors, and a frame fixing and supporting the shadow mask, wherein the] The shadow mask includes an effective surface having a plurality of slots and a non-effective surface surrounding the effective surface., wherein the slots includes first slots arranged on an outermost row arranged in a vertical axis direction of the effective surface of the shadow mask, second slots being adjacent to the first slots in the vertical axis direction, third slots being adjacent to the second slots in the vertical axis direction, and fourth slots being adjacent to the third slots in the vertical axis direction, and wherein a length of the vertical axis direction of

convexo-concave form on a luminescent body, white spots generated on an end



of the effective surface, and stains generated on a periphery of the screen, thereby providing a stable screen.--

In the Specification:

A marked-up version of the specification is attached hereto, showing the changes made.

In the Claims:

The claims have been amended as follows:

1. (Amended) A color CRT (Cathode Ray Tube) comprising:

a panel having a luminescent screen on an inner surface thereof;

a funnel connected to the panel;

an electron gun mounted on a neck part of the funnel, the electron gun emitting electron beams toward the luminescent screen;

a shadow mask disposed in a fixed interval to the luminescent screen formed on the inner surface of the panel, the shadow mask serving to select colors; and

a frame fixing and supporting the shadow mask, wherein the shadow mask includes an effective surface having a plurality of slots and a non-effective surface surrounding the effective surface, [;]

wherein the slots includes first slots, [arranged on] said first slots comprising each [an]outermost slot of adjacent vertical columns of slots, [row, arranged] in a vertical axis direction of the effective surface of the shadow mask, a horizontal row of second slots being adjacent to the first slots and having a slot opening extending in the vertical axis direction, a horizontal row of third

direction, said fourth slots being the length of perfect slots, [;] and

wherein smooth screen edges are obtained for the effective surface of the shadow mask at every length of the first slots between and inclusive of 70%-110% of a vertical length of a fourth slot [a length of the vertical axis direction of the first slots is in the range of 70% ~ 110% of a length of the vertical axis direction of the fourth slots].

4. (Amended) The color CRT is claimed in claim 1, wherein a minimum length of the vertical axis direction of the first slots is greater [more] than 63% of [the] a maximum length of the vertical axis direction of the first slots.

5. (Amended) A color CRT (Cathode Ray Tube) comprising:  
a panel having a luminescent screen on an inner surface thereof;  
a funnel connected to the panel;  
an electron gun mounted on a neck part of the funnel, the electron gun emitting electron beams toward the luminescent screen;  
a shadow mask disposed in a fixed interval to the luminescent screen formed on the inner surface of the panel, the shadow mask serving to select colors; and  
a frame fixing and supporting the shadow mask, wherein the shadow mask includes an effective surface having a plurality of slots and a non-effective surface surrounding the effective surface, [;] wherein the slots includes first slots, said first slots comprising each outermost slot of adjacent vertical columns of slots, [arranged on an outermost row arranged in a vertical axis direction of the effective surface of the shadow mask], [;] and

wherein a minimum length of the vertical axis direction of the first slots is [more] greater than 63% of [the] a maximum length of the vertical axis direction of the first slots.

## ABSTRACT OF THE DISCLOSURE

A CRT (Cathode Ray Tube), in which lengths of the vertical axes (Y-axes) of outermost row slots of a long side of a shadow mask, slots adjacent to the outermost row slots in a central direction of the shadow mask and slots adjacent to the adjacent slots in a central direction of the shadow mask are maintained in the range of 70% ~ 110% of a length of a vertical axis (Y-axis) of a perfect slot. The shadow mask includes an effective surface having a plurality of slots and a non-effective surface surrounding the effective surface. The color CRT can prevent the formation of convexo-concave form on a luminescent body, white spots generated on an end of the effective surface, and stains generated on a periphery of the screen, thereby providing a stable screen.



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MARKED-UP VERSION OF SPECIFICATION

CRT Containing Improved Slot Shape of Shadow Mask

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a CRT (Cathode Ray Tube), and more particularly, to a CRT, in which lengths of vertical axes (Y-axes) of outermost row slots of a long side of a shadow mask, slots adjacent to the outermost row slots in a central direction of the shadow mask and slots adjacent to the adjacent slots in a central direction of the shadow mask are maintained in the range of 70% ~ 110% of a length of a vertical axis (Y-axis) of a perfect slot, thereby providing a visually stable screen.

2. Description of the [Related] Background Art

[0002] As shown in FIG. 1, a conventional CRT (Cathode Ray Tube) includes a fluorescent surface 4 of R, G and B colors coated on an inner surface thereof, a panel 1 having a front surface on which an explosion-proof glass is fixed, a funnel 2 fused [on] to a rear end of the panel, an electron gun 3 inserted into a neck part 12 of the funnel and emitting electron beams 10, a shadow mask 5 mounted on an inner surface of the panel in a regular interval and having a plurality of holes for passing the electron beams, a frame 6 fixing and supporting the shadow mask and for maintaining the shadow mask in the regular interval from the inner surface of the panel, an inner shield 11 for shielding the CRT [not to be much effected by the earth] so as to reduce effects from the earth's magnetism, and a reinforcing band 7 mounted on the circumference of a side part of the panel for preventing [the] external shock.

[0003] [In the drawings, the unexplained reference] Reference numeral 8 indicates a deflection

[0004] As shown in FIG. 2, the shadow mask of the Background Art includes an effective surface 13 having a plurality of round or oval holes for passing electron beams 10 emitted

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from the electron gun 3, and a skirt part 14 [etched] partially etched and having a prescribed length for welding the frame supporting the shadow mask.

**[0005]** [FIG. 3 illustrates a conventional shadow mask. When] Referring to Fig. 3a, when the electron beams 10 emitted from the electron gun 3 pass the holes formed in the effective surface 13 of the shadow mask and strike the fluorescent surface 4 coated on the panel 1, a plurality of slots 15 of a fixed size are arranged horizontally and vertically in regular intervals to maintain the electron beams 10 in regular intervals[, and bridges]. Bridges (B) are formed between the adjacent slots 15 in regular intervals to maintain the intensity after forming the shadow mask.

**[0006]** The [conventional] CRT of the Background Art having the above structure has [the] an inner surface of the panel [not in flat type but] having a curvature, and [also] the shadow mask also has a curvature. [So,] Therefore, to [form] give the effective surface [into] the appearance of a flat [rectangle] rectangular shape when a user sees a screen, shapes of long and short sides of the effective surface of the shadow mask are calculated geometrically and manufactured in the form of a pin or a barrel.

**[0007]** [However, it] It is not difficult to manufacture the short side of the shadow mask into a desired shape even though a horizontal interval (Ph) of the slots 15 is changed, but it is very difficult to manufacture the long side of the shadow mask by changing a vertical interval (Pv). This is due to vertical wave patterns.

**[0008]** Therefore, lengths of a vertical axis direction (Y-axis) of the outermost row slots of the long side of the shadow mask are made to differ according to the effective surface. Thereby, because a shape of a long side end of the screen formed during an exposure process in a color CRT [is a convexo-concave forms, the] a convexo-concave shape is formed on

[0009] Referring to the drawings, the above problems will be described in more detail as follows:

[0010] [First, as] As shown in FIG. [4a] 3a, when the outermost row slots formed along the long side, [i.e., a vertical axis direction,] are formed in the convexo-concave shape, the shape of the end of the vertical axis direction of the screen formed during the exposure process is the convexo-concave form [as] shown in FIG. [5] 4. In the exposure process of the color CRT, an exposure device performs the exposure operation in the vertical axis direction to form graphite stripes on the inner surface of the panel. Thus, if the slots are more than a prescribed size, the light passing the slots of the shadow mask having the convexo-concave shape forms the graphite stripes of the same shape on the inner surface of the panel, and thereby the end of the effective surface of the screen has the convexo-concave shape during the luminescence of the screen. To remove the convexo-concave shape of the end of the effective surface, non-luminescent material must be coated on the stripes formed during the exposure process.

[0011] As shown in FIG. [4b] 3b, when the bridges between the outermost row slots of the vertical axis direction of the shadow mask and slots adjacent to the outermost row slots are removed and the slots are connected to the end of the effective surface and exposed, the effectual surface of the screen can have [the effective surface of] a straight line without the convexo-concave shape. However, as described later, the outermost row slots of the vertical axis direction of the shadow mask, in which the outermost row slots and the slots adjacent to the outermost row slots are connected and expanded, have a larger shadow mask transmissivity mask than [another] other adjacent slots, which are not connected. Thus, the electron beams passing the slots are formed relatively large on the screen, and thereby continuous white spots are formed on the end of the effective surface of the screen according

the vertical axis direction of the shadow mask and connected with the adjacent slots during the luminescence of the screen by the electron beams. Two equations are provided below.

**[0012]** Shadow Mask Transmissivity

= area of slot / (horizontal interval of slots x vertical interval of slots)

Shadow Mask Transmissivity in the case of connecting the outermost row slots and the adjacent slots

= (area of outermost row slots + area of the adjacent slots + area of bridges)

/ (horizontal interval of slot x vertical interval of slot)

**[0013]** When the bridges between the outermost row slots and slots positioned underneath the outermost row slots, which are located in the vertical axis direction of the shadow mask, are removed and the slots are connected to the end of the effective surface thereof, the portion where the slots are connected becomes lower in shadow mask intensity than a portion where the slots are not connected, when a curved surface of the effective surface of the shadow mask is formed, thereby causing a droop of the slots after the forming process of the shadow mask.

**[0014]** Moreover, if the slots of the same row number are formed in an entire area from the center of the shadow mask toward the periphery of the shadow mask by changing the vertical interval of the slots, vertical wave patterns may be formed on the screen due to an interference phenomenon between a scanning interval of the electron beams and the vertical interval of the slot.

### SUMMARY OF THE INVENTION

**[0015]** It is, therefore, an object of the present invention to provide a CRT(Cathode Ray Tube) capable of preventing a formation of a convexo-concave shape on upper and lower portions of a screen during the luminescence of the screen by maintaining lengths of outermost

FIGURE 1: A CROSS SECTIONAL VIEW OF THE SHADOW MASK AND SLOTS ADJACENT TO THE ADJACENT

slots in a central direction of the shadow mask in the range of 70 ~ 110% of a length of a vertical axis (Y-axis) of [a] perfect slots.

**[0016]** It is another object of the present invention to provide a color CRT capable of removing continuous white spots generated on an end of an effective surface by removing bridges between the outermost row slots arranged in the vertical axis direction of the shadow mask and slots arranged underneath the outermost row slots and by connecting the slots to the end of the effective surface and preventing stains of a periphery of the screen generated by short slots, thereby providing a visually stable screen.

**[0017]** To achieve the above objects, the present invention provides a color CRT including a panel having a luminescent screen on an inner surface thereof, a funnel connected to the panel, an electron gun mounted on a neck part of the funnel, the electron gun emitting electron beams toward the luminescent screen, a shadow mask disposed in a fixed interval to the luminescent screen formed on the inner surface of the panel, the shadow mask serving to select colors, and a frame fixing and supporting the shadow mask, wherein the shadow mask includes an effective surface having a plurality of slots and a non-effective surface surrounding the effective surface; wherein the slots includes first slots [arranged] on an outermost row arranged in a vertical axis direction of the effective surface of the shadow mask, second slots being adjacent to the first slots in the vertical axis direction, third slots being adjacent to the second slots in the vertical axis direction, and fourth slots being adjacent to the third slots in the vertical axis direction; and wherein a length of the vertical axis direction of the first slots is in the range of 70% ~ 110% of a length of the vertical axis direction of the fourth slots.

**[0018]** A length of the vertical axis direction of the second slots is in the range of 70% ~ 110% of a length of the vertical axis direction of the fourth slots, and a length of the vertical



## BRIEF DESCRIPTION OF THE DRAWINGS

**[0019]** Further objects and advantages of the invention can be more fully understood from the following detailed description taken in conjunction with the accompanying drawings in which:

**[0020]** FIG. 1 is a sectional view of a color CRT(cathode Ray Tube) of the Background Art;

**[0021]** FIG. 2 is a perspective view of a shadow mask for the color CRT shown in Fig. 1;  
[FIG. 3 is an enlarged view of an effective surface of the shadow mask;]

**[0022]** [FIG. 4] FIG. 3 is a view showing a shape of a slot of a [conventional] shadow mask of the Background Art;

**[0023]** [FIG. 5] FIG. 4 is a view showing a shape of a screen by the [conventional] shadow mask of the Background Art;

**[0024]** [FIG. 6] FIG. 5 is a view showing a shape of a slot according to an embodiment of the present invention;

**[0025]** FIG. [7] 6 is a view showing a shape of a slot according to another embodiment of the present invention;

**[0026]** FIG. [8] 7 is a view showing a shape of a screen of the present invention; and

**[0027]** FIG. [9] 8 is a view comparing the shape of the conventional screen and that of the screen of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[0028]** The present invention will now be described in detail in connection with preferred embodiments with reference to the accompanying drawings. For reference, like reference

**[0029]** In the present invention, slots are formed to have a luminescent body, radiated from an end of a long side of a shadow mask, not having a convexo-concave shape but having a straight effective surface.

**[0030]** As shown in FIG. [6] 5, the long side end of the shadow mask [means] refers to a portion near to a straight line connecting the outermost contours of the effective surface of the shadow mask from coordinates  $(-X_m, -Y_m)$  to coordinates  $(X_m, -Y_m)$  and a portion near to a straight line connecting the outermost contours of the effective surface of the shadow mask from coordinates  $(-X_m, Y_m)$  to coordinates  $(X_m, Y_m)$ , when the central coordinates of the effective surface of the shadow mask are  $(0, 0)$  and the diagonal coordinates of the effective surface of the shadow mask are  $(X_m, Y_m)$ .

**[0031]** As shown in FIGS. [6] 5 and [7] 6, outermost row slots of slots arranged parallel to a short axis, i.e., in a vertical axis direction are designated as first slots ( $S1\_1, S1\_2, S1\_3, \dots$ , and

$S1\_n$ ), lengths of Y-axes of the first slots are designated as  $S1\_Y1, S1\_Y2, S1\_Y3, \dots$ , and  $S1\_Yn$ , slots adjacent to the first slots in a central direction of the shadow mask are designated as second slots ( $S2\_1, S2\_2, S2\_3, \dots$ , and  $S2\_n$ ), lengths of Y-axes of the second slots are designated as  $S2\_Y1, S2\_Y2, S2\_Y3, \dots$ , and  $S2\_Yn$ , bridges between the first slots and the second slots are designated as  $B1\_1, B1\_2, B1\_3, \dots$ , and  $B1\_n$ .

**[0032]** Furthermore, slots, which are adjacent to the second slots in a central direction of the shadow mask, are designated as third slots ( $S3\_1, S3\_2, S3\_3, \dots$ , and  $S3\_n$ ), lengths of Y-axes of the third slots are designated as  $S3\_Y1, S3\_Y2, S3\_Y3, \dots$ , and  $S3\_Yn$ , and bridges between the second slots and the third slots are designated as  $B2\_1, B2\_2, B2\_3, \dots$ , and  $B2\_n$ .

**[0033]** If the lengths of Y-axes ( $S1\_Y1, S1\_Y2, S1\_Y3, \dots$ , and  $S1\_Yn$ ) of the first slots

are the same as the lengths of Y-axes of the second slots, and the lengths of Y-axes of the first slots are [formed] left "as is" without [changing as they are] change. If the lengths of Y-

axes of the first slots are less than 70% of those of the second slots, [the] bridges (B1\_1, B1\_2, B1\_3, ..., and

B1\_n) are formed between the first and second slots and the lengths of the Y-axes of the [first and] second slots are made [in] the same length as the Y-axes of the first slots.

[0034] At this time, if the lengths of the Y-axes of the second slots, which are equal to those of the first slots, are less than 70% of the lengths of the Y-axes (S3\_Y1, S3\_Y2, S3\_Y3, ..., and S3\_Yn) of the third slots (S3\_1, S3\_2, S3\_3, ..., and S3\_n), the Y-axes of the first, second and third slots are made in the same length. In this case, the lengths of the Y-axes of the first, second and third slots are stably formed in the range of 70% ~ 110% of the lengths of the Y-axes of fourth slots, which have a perfect slot shape.

[0035] As shown in FIG. [8] 7, the color CRT having the slots formed by the above method makes a shape of the screen uniform without convexo-concave shape, thereby minimizing a stepped interval of the effective surface of the shadow mask. Moreover, the color CRT does not change the vertical interval of the slots, thereby preventing the vertical wave patterns. As shown in FIG. [9] 8, the white spots of the end of the effective surface generated when an area of the slots is larger than an area of circumferential slots by connecting the first and second slots and stains of the periphery of the screen generated by not securing the minimum slot area required for the exposure can be prevented, thereby providing a stable screen.

[0036] Additionally, in the slots according to the present invention, because the minimum vertical directional length of the first slots is more than 64% of the minimum vertical directional length of the first slots, a difference in shadow mask transmissivity between the slots adjacent to each other is reduced, thereby reducing the white spots generated according to

[0037] As described above, in the present invention, when a user sees the screen through the outer surface of the panel of the color CRT, not to form the convexo-concave shape on the

luminescent body radiating at the long side end and to remove the stains on the screen generated when the lengths of the outermost row slots are short, the lengths of the Y-axes of the outermost row slots arranged in the vertical axis direction of the shadow mask, the slots adjacent to the outermost row slots in the central direction of the shadow mask and the slots adjacent to the adjacent slots to the outermost row slots in the central direction of the shadow mask are maintained in the range of 70% ~ 110% of the lengths of the slots having the perfect slot shape, thereby minimizing the stepped interval of the effective surface of the shadow mask by making the shape of the screen uniform without the convexo-concave shape, and preventing the vertical wave patterns by not changing the vertical interval of the slots. Furthermore, by connecting the outermost row slots and the adjacent slots to the outermost row slots, it is prevented that the white slots of the end of the effective surface are generated when the area of the slots is larger than that of the adjacent slots. Additionally, it is prevented that the stains of the periphery of the screen are generated when the minimum area of the slots required for exposure is not secured. Through the above effects, the present invention can provide the stable screen.

**[0038]** While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments but only by the appended claims. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.